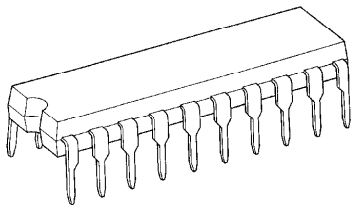
TOSHIBA CMOS DIGITAL INTEGRATED CIRCUIT SILICON MONOLITHIC

TC9290P, TC9290F

KEY SCAN IC

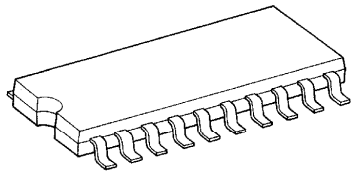
TC9290P, TC9290F is detected key input and transmitted serial data to controller which is suited for extension of DTS or MPU.
Especially, this IC is available for "KEY DETACHABLE SECURITY SYSTEM" of car audio.

TC9290P



DIP20-P-300-2.54A

TC9290F



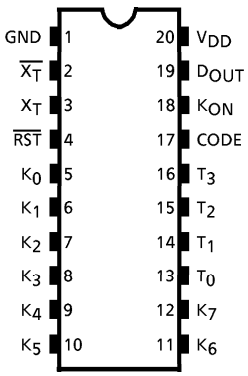
SOP20-P-300-1.27

Weight
DIP20-P-300-2.54A : 1.4g (Typ.)
SOP20-P-300-1.27 : 0.48g (Typ.)

FEATURES

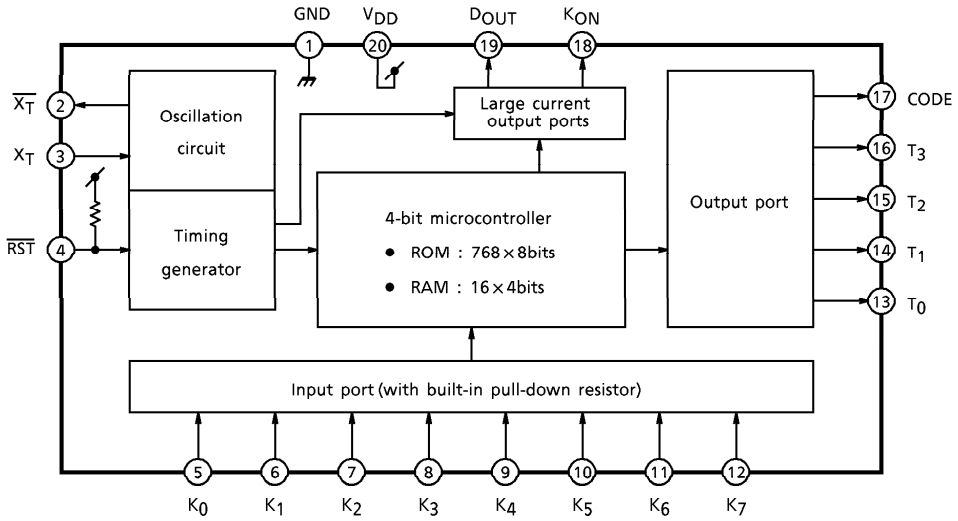
- Wide range of operation supply voltage and low static current.
  : V_{DD} = 3.0~5.5V
  : $I_{DQ} \leqq 5.0\mu A$ (at stand-by mode)
- Communicate with controller by one bus lines. (D_{OUT} of Pin19)
- 32functions are basically available.
  Up to 112commands (28 × 4 = 112) can be output by double pushing.
- Serial data can be changed the remote control code (Format of TC9243P, TC9243F) and the key data code (Omission code) methods.
- Packages in two types : DIP and FLAT types are available.
  DIP20 : TC9290P
  SOP20 : TC9290F

PIN CONNECTION (TOP VIEW)



980910EBA2

BLOCK DIAGRAM



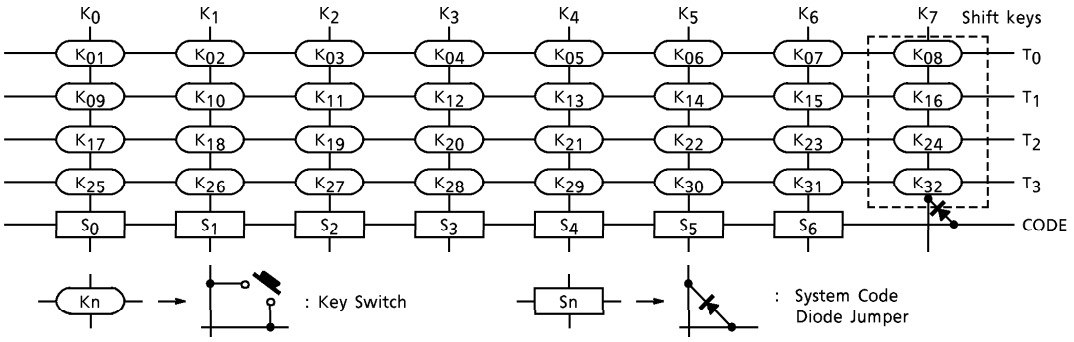
TERMINAL FUNCTION

PIN No.	SYMBOL	PIN NAME	FUNCTION & OPERATION
1	GND	Power Terminal	Applies supply voltage. (V_{DD} = 3.0~5.5V)
20	V_{DD}		
2	$\overline{X_T}$	Oscillation Terminal	Input / output terminals for the ceramic oscillators, with built-in amplifier circuit and feedback resistor.
3	X_T		
4	$\overline{RST}$	Reset Input	When this pin is set at "L" level, the inside is initialized. With a built-in pull-up resistor.
5~12	K_0~K_7	Key Inputs	The input terminals for key matrix. Each of all the pins has a built-in pull-down resistor.
13~16	T_0~T_3	Key Scan Output	The key matrix scan output terminals. C-MOS output.
17	CODE	Code Scan Output	The terminal for selected remote control code and key data code mode. At the remote control code mode, this terminal is output system code scan signal. P-ch open drain output.
18	K_{ON}	Key Input Detector Output	This terminal is output "L" level when the key is input. CMOS output.
19	D_{OUT}	Serial Data Output	Serial data output terminal. ("H" level output) CMOS output.

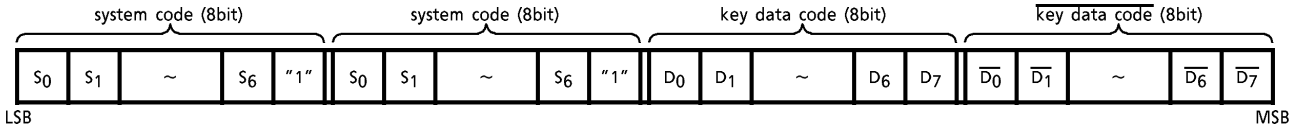
DESCRIPTION OF OPERATION

1. OUTPUT MODE OF REMOTE CONTROL CODE

The TC9290P, TC9290F enables the setting of maximum 32keys in combination of K_0~K_7 and T_0~T_3 keys when code output terminal of pin17 connect to key input terminal of pin12 by the diode jumper.
Further, system codes are stable in combination of K_0~K_6 and code keys by the diode jumper.



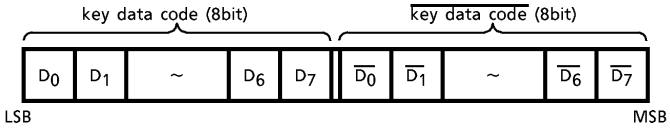
- $K_{08, 16, 24}$ and $_{32}$ (the shift key) keys can be pushed simultaneously with other keys (the normal keys). However, the simultaneous keying of the shift keys and that of the normal keys are prohibited.
- The system code setting is made by the diode jumper between "CODE" key and "K_0~K_6" keys. With the diode jumper, data code will become "L".
  Further, "S_7" code is fixed at "1" and cannot be changed.
- Data format (32bit data)



NOTE : At the remote control code mode, data format is same as TC9243P, TC9243F of infrared remote control signal transmission IC.
However, it does not include modulation by 38kHz of carrier frequency.

2. OUTPUT MODE OF KEY DATA CODE

When code output terminal of pin17 is set at open, it will become key data code (commission mode) .



3. KEY DATA CODE

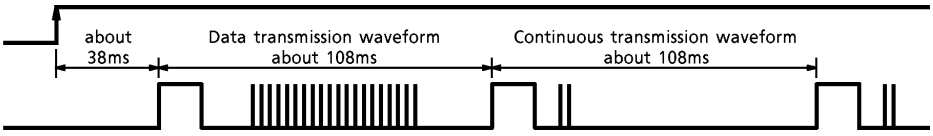
Key No.	Tn	Kn	D_0	D_1	D_2	D_3	D_4	D_5	D_6	D_7
K_{01}	T_0	K_0	1	0	0	0	0	○ Shift key data ○ "000" except dual keying		
K_{02}		K_1	0	1	0	0	0			
K_{03}		K_2	1	1	0	0	0			
K_{04}		K_3	0	0	1	0	0			
K_{05}		K_4	1	0	1	0	0			
K_{06}		K_5	0	1	1	0	0			
K_{07}		K_6	1	1	1	0	0			
K_{08}		K_7	○ Normal key data ○ "00000" except dual keying					1	0	0
K_{09}	T_1	K_0	1	0	0	1	0	○ Shift key data ○ "000" except dual keying		
K_{10}		K_1	0	1	0	1	0			
K_{11}		K_2	1	1	0	1	0			
K_{12}		K_3	0	0	1	1	0			
K_{13}		K_4	1	0	1	1	0			
K_{14}		K_5	0	1	1	1	0			
K_{15}		K_6	1	1	1	1	0			
K_{16}		K_7	○ Normal key data ○ "00000" except dual keying					1	1	0
K_{17}	T_2	K_0	1	0	0	0	1	○ Shift key data ○ "000" except dual keying		
K_{18}		K_1	0	1	0	0	1			
K_{19}		K_2	1	1	0	0	1			
K_{20}		K_3	0	0	1	0	1			
K_{21}		K_4	1	0	1	0	1			
K_{22}		K_5	0	1	1	0	1			
K_{23}		K_6	1	1	1	0	1			
K_{24}		K_7	○ Normal key data ○ "00000" except dual keying					1	0	1
K_{25}	T_3	K_0	1	0	0	1	1	○ Shift key data ○ "000" except dual keying		
K_{26}		K_1	0	1	0	1	1			
K_{27}		K_2	1	1	0	1	1			
K_{28}		K_3	0	0	1	1	1			
K_{29}		K_4	1	0	1	1	1			
K_{30}		K_5	0	1	1	1	1			
K_{31}		K_6	1	1	1	1	1			
K_{32}		K_7	○ Normal key data ○ "00000" except dual keying					1	1	1

Normal key : K_{01}~K_{07}, K_{09}~K_{15}, K_{17}~K_{23}, K_{25}~K_{31}
Shift key : K_{08}, K_{16}, K_{24}, K_{32}

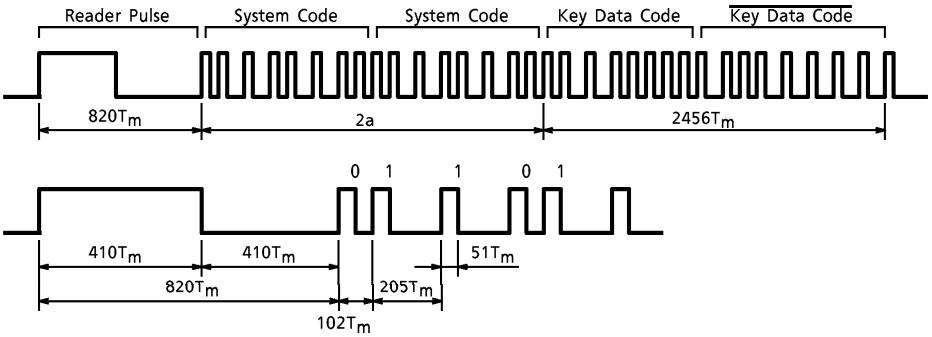
4. SERIAL DATA (TX_{out}) OUTPUT WAVEFORM ($T_m = 5 / f_{OSC}$: system clock)

(1) Remote Control Data Mode

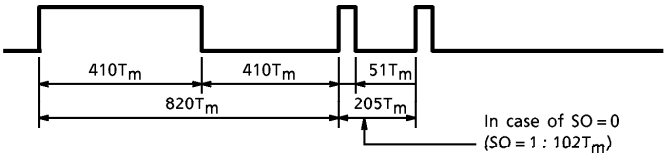
Key ON (In case of $f_{OSC} = 455kHz$)



Data transmission waveform

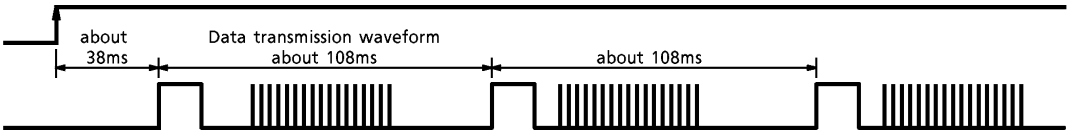


Continuous transmission waveform

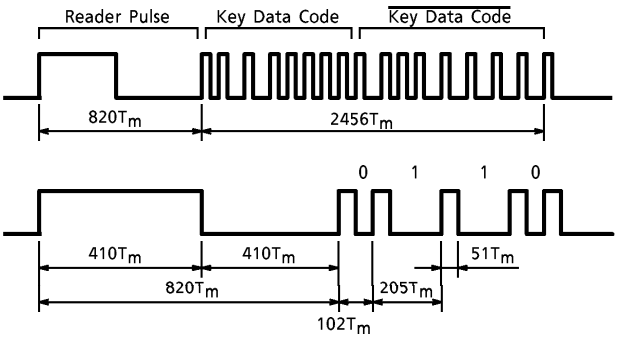


(2) Key Data Mode

Key ON (In case of $f_{OSC} = 455kHz$)



Data transmission waveform



MAXIMUM RATINGS (Ta = 25°C)

CHARACTERISTIC	SYMBOL	RATING	UNIT
Supply Voltage	V_{DD}	−0.3~6.0	V
Input Voltage	V_{IN}	V_{SS} −0.3~V_{DD} +0.3V	V
Output Current	I_{OUT}	−20	mA
Power Dissipation	P_D	350 (300) *	mW
Operating Temperature	T_{opr}	−40~85	°C
Storage Temperature	T_{stg}	−65~150	°C

* : The value shown in parenthesis applies to the TC9290F.

ELECTRICAL CHARACTERISTICS

Recommended operating conditions

(Unless otherwise specified, V_{DD} = 5.0V, Ta = 25°C, For items with an asterisk (*), Ta = −40~85°C)

CHARACTERISTIC	SYMBOL	TEST CIR-CUIT	TEST CONDITION	MIN.	TYP.	MAX.	UNIT
Operating Supply Voltage *	V_{DD}	—	—	3.0	5.0	5.5	V
Oscillation Frequency *	f_{OSC}	—	—	400	455	800	kHz
Input High Voltage	V_{IH}	—	(except $\overline{RST}$)	V_{DD} ×0.7	—	V_{DD}	V
Input High Voltage	V_{IH}	—	($\overline{RST}$)	V_{DD} ×0.8	—	V_{DD}	V
Input Low Voltage	V_{IL}	—	(except $\overline{RST}$)	0	—	V_{DD} ×0.3	V
Input Low Voltage	V_{IL}	—	($\overline{RST}$)	0	—	V_{DD} ×0.2	V

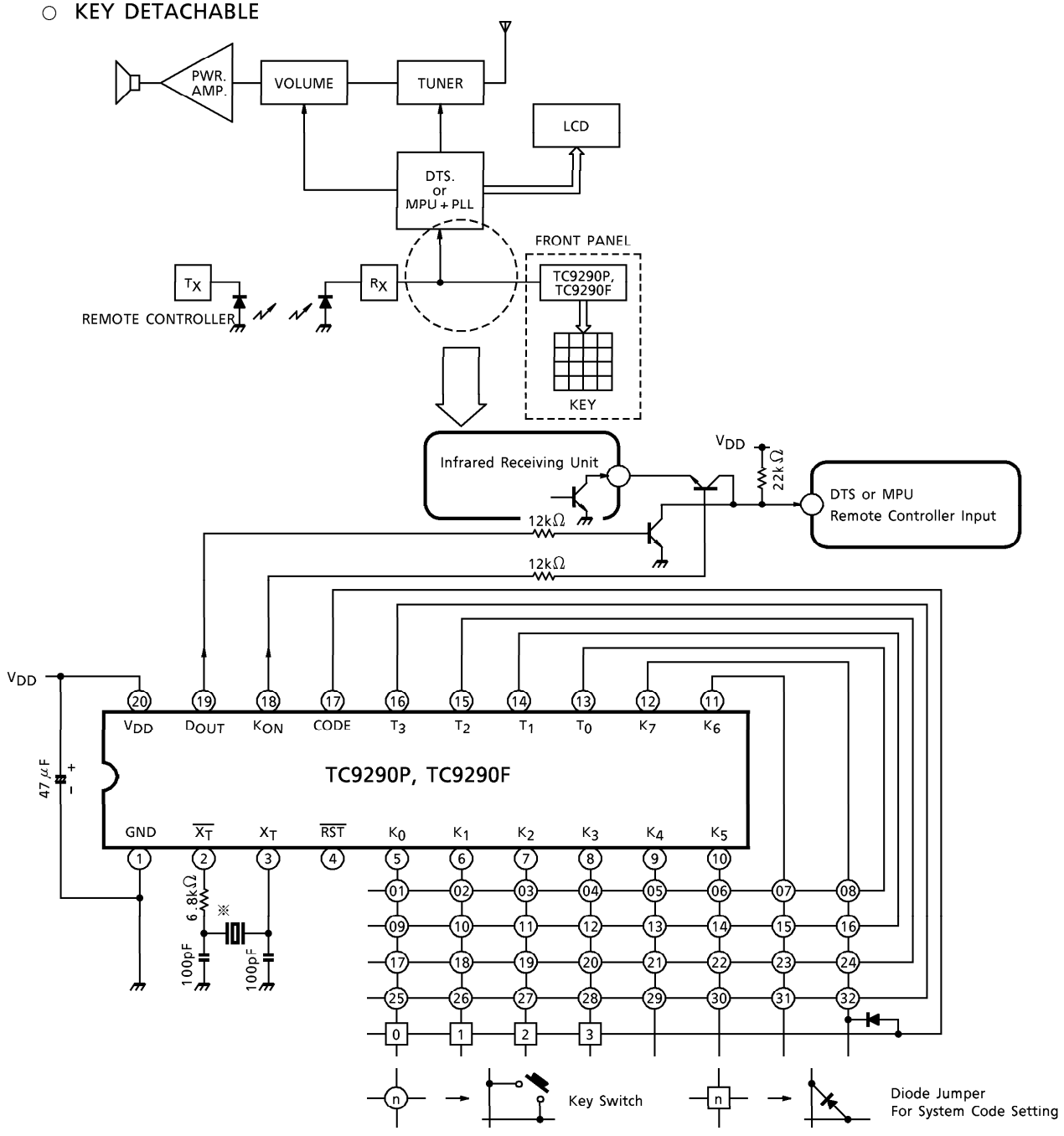
DC CHARACTERISTICS (Unless otherwise specified, V_{DD} = 5.0V, Ta = 25°C)

CHARACTERISTIC	SYMBOL	TEST CIR-CUIT	TEST CONDITION	MIN.	TYP.	MAX.	UNIT
Operating Supply Voltage	I_{DD}	—	f_{OSC} = 455kHz	—	0.5	1.2	mA
Static Supply Current	I_{QD}	—	Hold Mode	—	—	5.0	μA
Pull-Down Resistor	R_D	—	(K_0~K_7)	100	200	400	kΩ
Pull-Up Resistor	R_U	—	($\overline{RST}$)	25	50	100	kΩ
Output High Current	I_{OH}	—	(TX_{out}) V_{OH} = 1.5V	−10	−20	—	mA
Output Low Current	I_{OL}	—	(TX_{on}) V_{OL} = 1.5V	5	10	—	mA
Input Leak Current	I_{LI}	—	V_{IN} = V_{DD}, GND	−1.0	—	1.0	μA

APPLICATION CIRCUIT

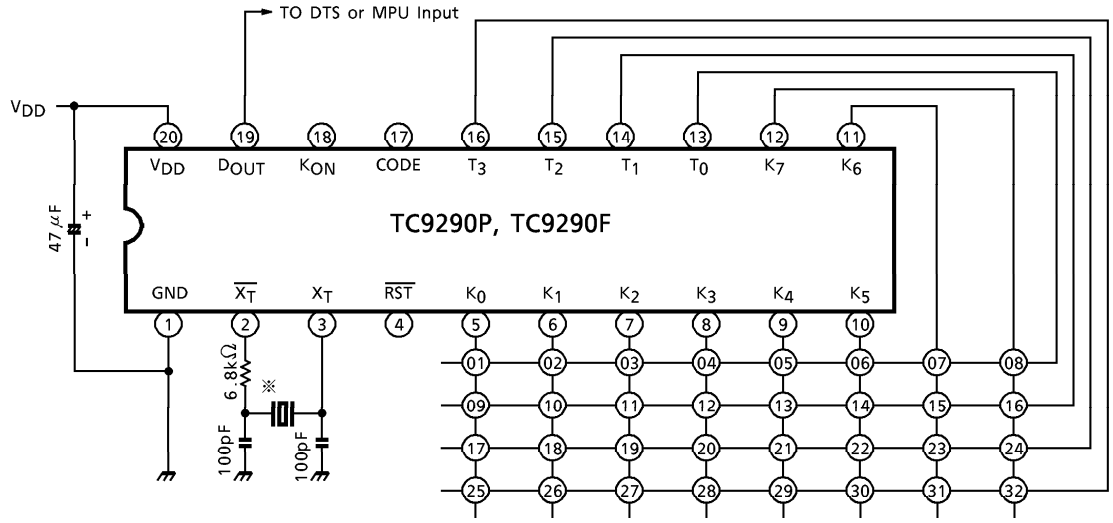
1. COMMONLY USE WITH INFRARED REMOTE CONTROL IC (TC9243P, TC9243F)

○ KEY DETACHABLE



※ Ceramic Oscillator CSB455B (Murata Sesakusho) or Equivalent.

2. EXTENSION FOR INPUT KEY

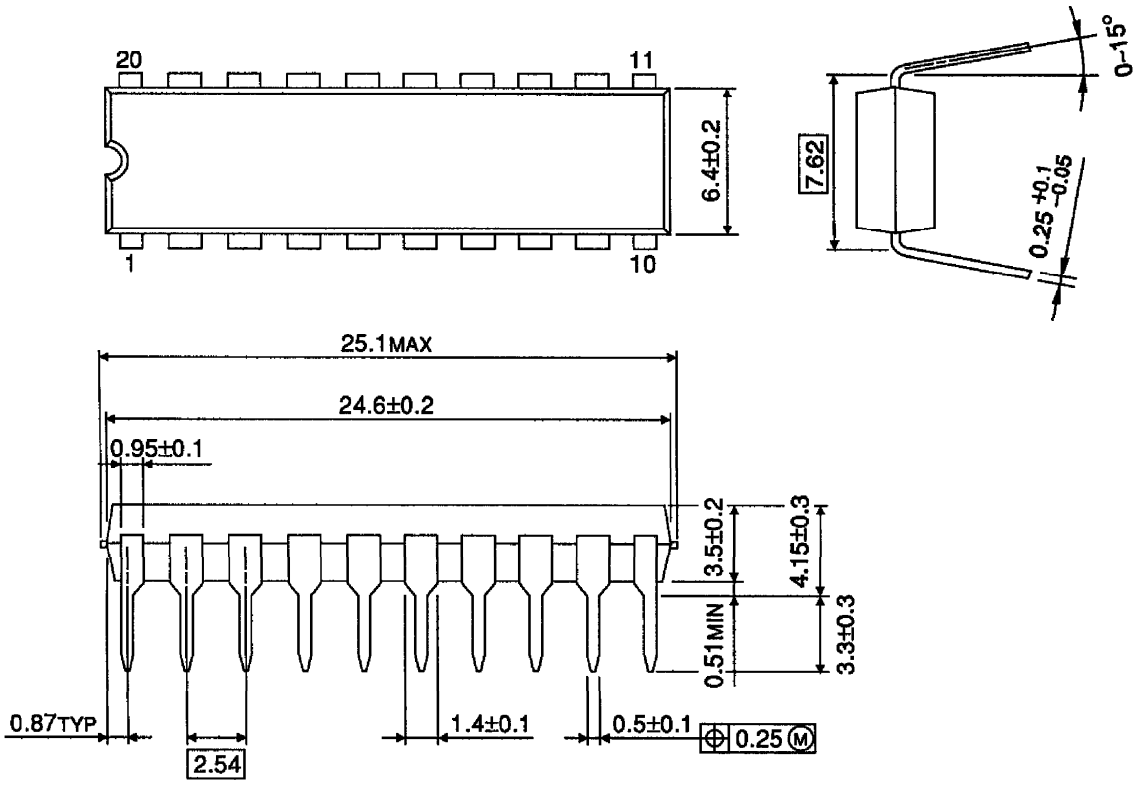


※ Ceramic Oscillator CSB455B (Murata Seisakusho) or Equivalent.

OUTLINE DRAWING

DIP20-P-300-2.54A

Unit : mm

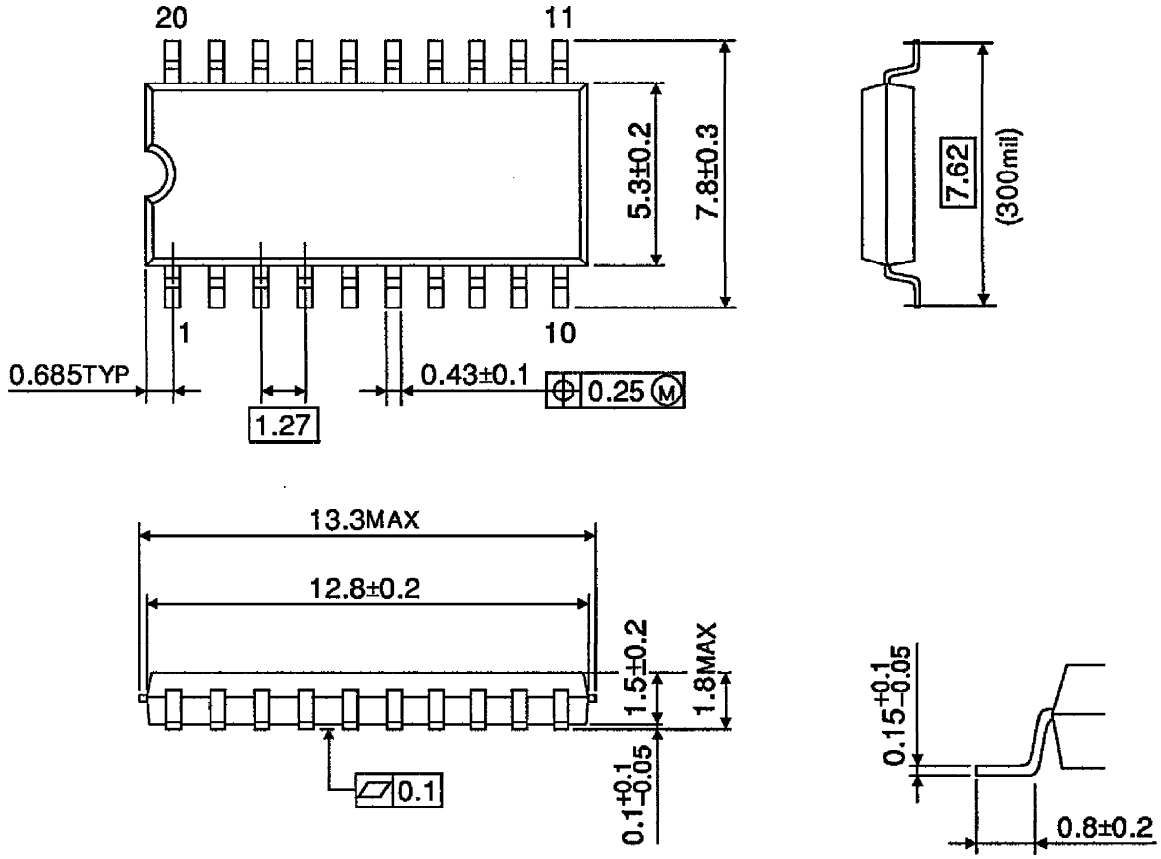


Weight : 1.4g (Typ.)

OUTLINE DRAWING

SOP20-P-300-1.27

Unit : mm



Weight : 0.48g (Typ.)